2-10-87

T-9 SOILS DATA 7a

(HYDROCARBON VAPORS @ 2/10/1987 - CITY FOODS SITE)

REPORT OF GEOTECHNICAL ENGINEERING SERVICES
PROPOSED FACILITIES EXPANSION
SEATTLE, WASHINGTON
FOR
CITY ICE AND COLD STORAGE COMPANY

GeoEngineers Incorporated

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Incorporated

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February 10, 1987

City Ice and Cold Storage Company
259 Coleman Building
Seattle, Washington 98104

Attention: Mr. John C. Rosling, President

Gentlemen:

We are pleased to submit four copies of our "Report of Geotechnical Engineering Services, Proposed Facilities Expansion, Seattle, Washington." The scope of services initially proposed for this investigation is described in our proposal dated October 31, 1986. This scope was modified as the details of the proposed expansion changed during preliminary planning for the expansion. These modified services were authorized verbally by Mr. Gary Ostle, Project Manager, of Derek Arndt Construction Company on January 13, 1987. During the course of the investigation, frequent discussions have been held with Mr. Ostle to discuss the progress of our investigation and our preliminary findings and recommendations.

It has been our pleasure to serve you. Please contact us if you have any questions regarding our findings and recommendations. We are available to respond to design questions and to provide construction monitoring services during filling and pile driving. We look forward to assisting you.

Yours very truly,

GeoEngineers, Inc.

Jack K. Tuttle
Principal

KGB:JKT:cs

cc: Thomas A. Sconzo, A.I.A.
Derek Arndt Construction Co.

File No. 1074-01

TABLE OF CONTENTS

List of Figures

APPENDIX

Appendix Figures

REPORT OF GEOTECHNICAL ENGINEERING SERVICES
PROPOSED FACILITIES EXPANSION
SEATTLE, WASHINGTON
FOR
CITY ICE AND COLD STORAGE COMPANY

INTRODUCTION

This report presents the results of our geotechnical investigation for the proposed expansion of facilities at Building 39 on Pier 91 for City Ice and Cold Storage Company in Seattle, Washington. The proposed expansion, as planned, will entail the construction of a new freezer building immediately north of Building 39. The project location is shown with respect to adjacent features on the Site Plan, Figure 1.

SCOPE

The purpose of our services is to explore and evaluate subsurface conditions as they will affect the proposed expansion. Specifically our scope of services includes:

1. Exploring subsurface soil and ground water conditions in the proposed building area by drilling five borings with a total estimated footage of approximately 300 linear feet.
2. Performing sufficient laboratory testing to determine pertinent engineering and physical characteristics for the soils affected by the proposed construction.
3. Providing recommendations for foundation support for the proposed building assuming that piles will be required.
4. Developing recommendations for support of the floor slab in the proposed building and evaluating the potential influence on the recommended foundation support system.
5. Estimating the magnitude and rates of settlement of the foundations, floor slab, and any fill placed to support the floor slab.
6. Recommending a preload or surcharge program to induce consolidation of the underlying soils in advance of building construction, if appropriate.

7. Evaluating the probable effects of the proposed construction on adjacent building foundations and buried utilities.

8. Outlining procedures for capping the existing well in accordance with State of Washington requirements and consulting with water well drilling contractors to develop a cost estimate for the work.

PROJECT DESCRIPTION

The preliminary plans for the proposed building indicate dimensions of approximately 280 feet in length and 130 feet in width. The building is planned as a three-story structure with the first floor at dock height or about 4 feet above the adjacent yard grade. A 30-foot-wide loading dock for trucks is planned along the west side of the building and a 12-foot-wide loading dock is planned along the east side of the building adjacent to the railroad tracks. The south wall of the new building will be located approximately 50 feet north of the north wall of Building 39, although this distance may be greater in order to accommodate existing facilities and utilities. We understand that design floor loads are expected to be in the range of 250 to 300 pounds per square foot. Detailed building design has not yet been completed and estimated column loads are not yet available.

An artesian well and pumps are located in a concrete and concrete block well house approximately 20 to 30 feet north of the north wall of Building 39. This well will be capped as part of the planned building construction.

SITE CONDITIONS

SURFACE CONDITIONS

The general area surrounding and including Pier 91 was originally an inlet of Smith Cove. In the early 1900s, the inlet was filled and a few years later the area was purchased by the U.S. Navy for development as a naval pier with associated facilities. In the 1970s, the area was acquired by the Port of Seattle for use as part of their shipping and storage facilities.

Presently, the site of the proposed building is a yard and storage area paved with asphalt concrete. A railroad spur crosses the site in a curved diagonal from the northeast to the southwest corners of the area. Water lines with fire hydrants, gas lines, storm sewer, and sanitary sewer lines

cross the site. The site surface is generally level with surface variations being less than approximately 2 feet. The surface of the area is presently unoccupied except for new automobiles parked in the northern part and debris containers and shipping pallets in the southern part.

SUBSURFACE CONDITIONS

The subsurface conditions at the site were explored by drilling five borings at the locations shown on the Site Plan. Descriptions of the field explorations, boring logs, laboratory testing procedures, and test results are presented in Appendix A.

The results of our explorations indicate the site is underlain by a layer of sandy fill material which varies in thickness from approximately 6 to 11 feet. This fill is underlain by a layer of soft silt and sandy silt with woody organic material which appears to be old bottom deposits. The silt layer varies in thickness from approximately 3 to 5 feet in Borings 1, 2, 4, and 5, but was not encountered in Boring 3. The silt layer in Borings 1, 2, 4, and 5 and the fill in Boring 3 are underlain by loose to medium dense silty sand and sand with gravel and many shell fragments. This material extends to depths ranging from approximately 20 feet in Boring 1 to approximately 31 feet in Boring 4. The silty sand and sand is in turn underlain by medium dense to dense sand with gravel and shell fragments. Boring 5 was terminated in this material at a depth of approximately 50 feet. Soft and loose silt and silty sand was encountered in Borings 1 through 4, underlying the sand with gravel. These borings were terminated in this silty material at depths of approximately 60 feet in Borings 2 and 4 and approximately 70 feet in Borings 1 and 3. A subsurface soil profile developed from our interpretation of the data obtained is presented in Figure 2.

Water was encountered in all of the borings at depths of about 6 to 7 feet. Observation wells were installed in Borings 1 and 2 to permit observation of water levels after completion of drilling and backfilling of the borings. The observed water levels are shown on the respective boring logs in the Appendix. We expect that these observed water levels will vary with fluctuations in rainfall and runoff and also with tidal fluctuations.

In Boring 2, at a depth of approximately 13 feet, soil was encountered which emitted a strong odor of hydrocarbons. Also, a sheen was observed on the water from the sample. The sample of soil at this depth appeared darker in color at the time of sampling than samples of similar soils obtained from approximately the same depth in the other borings.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

The sand and gravel underlying the site will provide support for displacement piles driven to depths of approximately 40 feet. Floor slabs may be supported on structural fill placed to dock height with levels of settlement within the range normally considered acceptable for buildings of this type. More detailed discussion of foundation and floor slab support together with other building, site design, and construction considerations is presented in the following sections.

FOUNDATION SUPPORT

We recommend that the proposed building be supported on piles founded in the medium dense to dense sand with gravel which was encountered in the borings underlying the site. We have evaluated the allowable bearing capacity of treated timber piles driven to the recommended tip elevation in the sand and gravel. Treated timber piles with a nominal tip diameter of 8 inches and driven to a penetration of approximately 40 feet below existing grade may be designed for an allowable capacity of 25 tons per pile. If piles with a nominal tip diameter of 9 inches are used, they may be designed for an allowable capacity of 30 tons per pile with a penetration of 40 feet below existing grade.

The recommended capacities are intended to apply to the total of all dead and long-term live loads with a one-third increase for the total of all loads including short-duration transitory loads such as wind or seismic.

Piles driven in a group should be installed at a minimum distance of 3 times the diameter of the pile butts between adjacent piles. Because some densification of the underlying granular materials is expected during pile driving, we do not anticipate the need for a reduction in allowable bearing capacity per pile due to group efficiency.

We recommend that installation of piles be monitored by qualified personnel who will evaluate the adequacy of actual penetration and driving resistance with that anticipated. This evaluation should include a comparison of predicted capacities with those determined by appropriate dynamic formulas. These data, combined with detailed records of driving resistance will provide the means for detecting variations in subsurface conditions not encountered in the test borings. All piles should penetrate to a minimum depth of 30 feet below the existing site grade. Predrilling of piles may be required if practical refusal to driving is encountered before this minimum penetration is achieved. However, jetting should not be permitted.

SETTLEMENT OF PILES

Settlement of individual piles designed for the allowable capacities and installed as recommended is expected to be negligible. Settlement of pile groups will vary depending on the size and configuration of the pile group. We estimate that a 36-pile group arranged in a square configuration with the piles designed and installed as recommended above will experience settlement of approximately 1-1/2 to 2 inches or less. For a 9-pile group in a square configuration, we estimate settlement of approximately 1 inch or less. Settlements are expected to be relatively uniform between comparably loaded adjacent pile groups. More specific evaluation of estimated settlements can be completed when column loads, spacing, and other design data are available.

FLOOR SLAB SUPPORT

It is our understanding that the grade of the first floor is planned at dock height, or about 4 feet above existing yard grade. We recommend that the planned floor be supported on compacted structural fill placed over the existing surface. This structural fill should consist of granular material containing only a minor percentage of material smaller than the No. 200 sieve. A slight increase in percentage of fine material makes the soil sensitive to increases in moisture content with the result that the material cannot be placed and properly compacted during rainy periods. Fill material used during dry weather should have less than about 10 percent by dry weight passing the No. 200 sieve. In wet weather this percentage of fines should

not exceed 5 percent. The structural fill should be placed in lifts with a maximum loose thickness of 8 inches and compacted to 95 percent of the maximum dry density determined in accordance with ASTM D-1557. The structural fill should be placed directly on top of the existing asphalt pavement to take advantage of the stiffness and load distribution provided by the pavement structure. Since the structural fill supporting the floor slab will be contained within the footing walls, it is not expected that water will be entering the fill. However, it will be desirable to make provisions for positive drainage of any water that might collect between the bottom of the fill and the surface of the asphalt pavement.

SETTLEMENT OF STRUCTURAL FILL AND FLOOR SLAB

For a floor slab supporting loads of 250 to 300 pounds per square foot and in turn supported on structural fill placed and compacted as recommended above, settlements are expected to be less than approximately 2-1/2 to 3 inches. Approximately one-third of this estimated settlement is due to the loads imposed by the floor slab, with the remainder due to the weight of structural fill. We anticipate that such settlement will be relatively uniform across the site assuming evenly distributed floor loads. We estimate that differential settlement between the pile-supported building frame and the floor slab supported on structural fill will be less than 1/2 inch.

We recommend that the fill required to establish design floor grade be placed in advance of pile driving. The fill should be in place at least 2 weeks before pile driving begins so that consolidation in the upper compressible soils will be largely complete. This will eliminate the imposition of downdrag on the piles and reduce postconstruction differential settlements between the floor slab and the pile-supported structural frame.

Settlement markers should be installed prior to placement of the fill and monitored during and after fill placement so that rates and amounts of settlement can be determined and the two-week waiting period adjusted, if necessary. Two types of markers should be installed since the controlling factor of when pile driving should begin is the rate of consolidation in the upper soil strata. Consolidation in the deep silty soils will continue for a longer period, but will affect both the slab and the piling the same. One

type should be placed on the existing surface to measure the overall settlement. The second type should be installed at a depth of approximately 10 to 12 feet in the sand and silty sand underlying the old bottom deposits. Comparing the readings from both sets of markers will provide data for evaluating consolidation of this silt layer and deciding when pile driving should begin.

PRELOADING

Excess fill can be placed to preinduce settlements in the upper soils due to floor loads if moderate differential settlement between the floor slab and the building frame are unacceptable. We estimate that differential settlements could be in the range of 1/2 to 1 inch, depending on the magnitude and direction of actual floor loading. If preloading is used, we recommend that 1 foot of fill be placed for each 100 pounds per square foot design floor load. The preload fill should be placed with the strucural fill pad. Pile driving should be deferred until the excess fill is removed.

VENTING OF HYDROCARBON VAPORS

Evidence of hydrocarbon products was encountered in Boring 2. There is a potential that vapors from these hydrocarbon products could accumulate beneath the building floor slab. This especially could be the case if equipment pits or elevator shafts extend into the underlying soils. We recommend that this potential be carefully evaluated with regard to the proposed design and building use and venting systems be provided, as appropriate.

EFFECT ON UTILITIES AND OTHER FACILITIES

It is our understanding that all of the utilities crossing the site under the proposed building will be relocated. It is also our understanding that the utilities will be located at relatively shallow depths in the existing layer of fill material. As such, we do not expect the structural fill or piles to adversely affect these utilities. Normal precautions and all applicable city, state, and federal regulations should be followed during construction work at the site.

Since the proposed new building will be located 50 feet or more from the existing building, we do not expect the new building loads to affect the

existing building. Vibrations during driving of piles may be felt within the existing structure. We do not expect these vibrations to adversely affect the operation of equipment within the structure. We recommend that this be verified by closely monitoring ground motions in the existing building and on sensitive equipment at the beginning of pile installation.

EXISTING RAILROAD TRACKS

An existing railroad spur crosses the proposed building site. Since the site was an inlet of Smith Cove with railroad lines on trestles across the inlet, there is the possibility that this spur is supported on piles. However, we have not made a specific investigation to determine if the tracks are supported on ballast or piles. If it is established that this track is pile supported, the piles should be cut off when the track is relocated to avoid a zone of little or no settlement of the structural fill over the tracks with a sharp differential settlement on either side of the tracks. The piles should be cut off approximately 4 feet below the ground surface, capped with a 3- to 4-inch thickness of styrofoam, and the resulting excavation backfilled with structural fill as recommended in a previous section of this report.

CAPPING ARTESIAN WELL

The State of Washington has established minimum standards for the construction and maintenance of water wells. These standards are published as Chapter 173 - 160 of the Washington Administrative Code. Capping the artesian well north of Building 39 must be done in accordance with these regulations. Generally, these regulations require that the well be sealed at the confining layer over the artesian layer and also at the ground surface. Also included are requirements concerning control of leakage around the well casing and installing a control valve for completely controlling the flow from the well. A local licensed well driller indicated that a rough estimate for performing the necessary work to cap this well would be about $500 to $1,000. This assumes no complicating factors or unusual installation. Abandoning a well is much more involved and expensive. It is not possible to estimate the costs associated with abandoning a well without examining the installation and reviewing the well log.

USE OF THIS REPORT

We have prepared this report for use by City Ice and Cold Storage Company and your architects and engineers in design of a portion of this project. The data and report should be provided to prospective contractors for their bidding or estimating purposes, but our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

The full design details are not known at the time of preparation of this report. As your design develops, we expect that additional consultation will be necessary to provide for modification or adaptation of our recommendations.

When the design has been finalized, we recommend that we be retained to review pertinent design drawings and specifications to see that our recommendations have been interpreted and implemented as intended.

The scope of our services does not include services related to construction safety precautions and our recommendations are not intended to direct the contractor's methods, techniques, sequences or procedures, except as specifically described in our report for consideration in design.

There are possible variations in subsurface conditions between the explorations and also with time. A contingency for unanticipated conditions should be included in the budget and schedule. Sufficient monitoring, testing and consultation should be provided by our firm during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether or not earthwork and foundation installation activities comply with contract plans and specifications.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in this area at the time the report was prepared. No other conditions, express or implied, should be understood.

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The conclusions and recommendations in this report should be applied in their entirety. If there are any questions concerning this report or if we can provide additional services, please call.

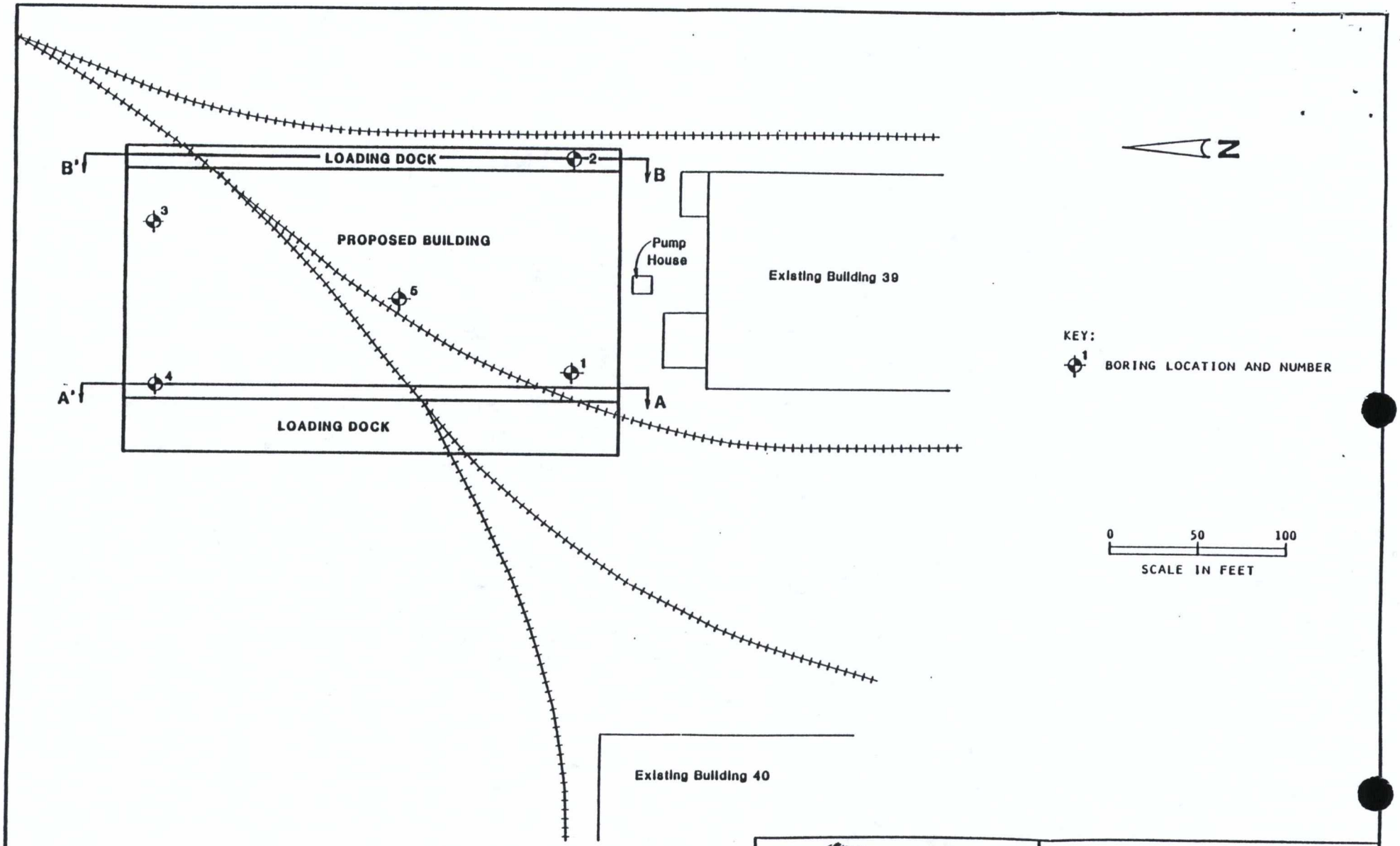
Respectfully submitted,

GeoEngineers, Inc.

Kenneth G. Buss
Senior Engineer

for Jack K. Tuttle
Principal

KGB:JKT:cs



REFERENCE: DRAWING ENTITLED "TOPOGRAPHIC AND UTILITY SURVEY - AREA SURROUNDING AND NORTH OF BUILDING 39" BY HARSTAD CONSULTANTS FOR CITY ICE AND ICE STORAGE COMPANY, DATED JAN. 1987.

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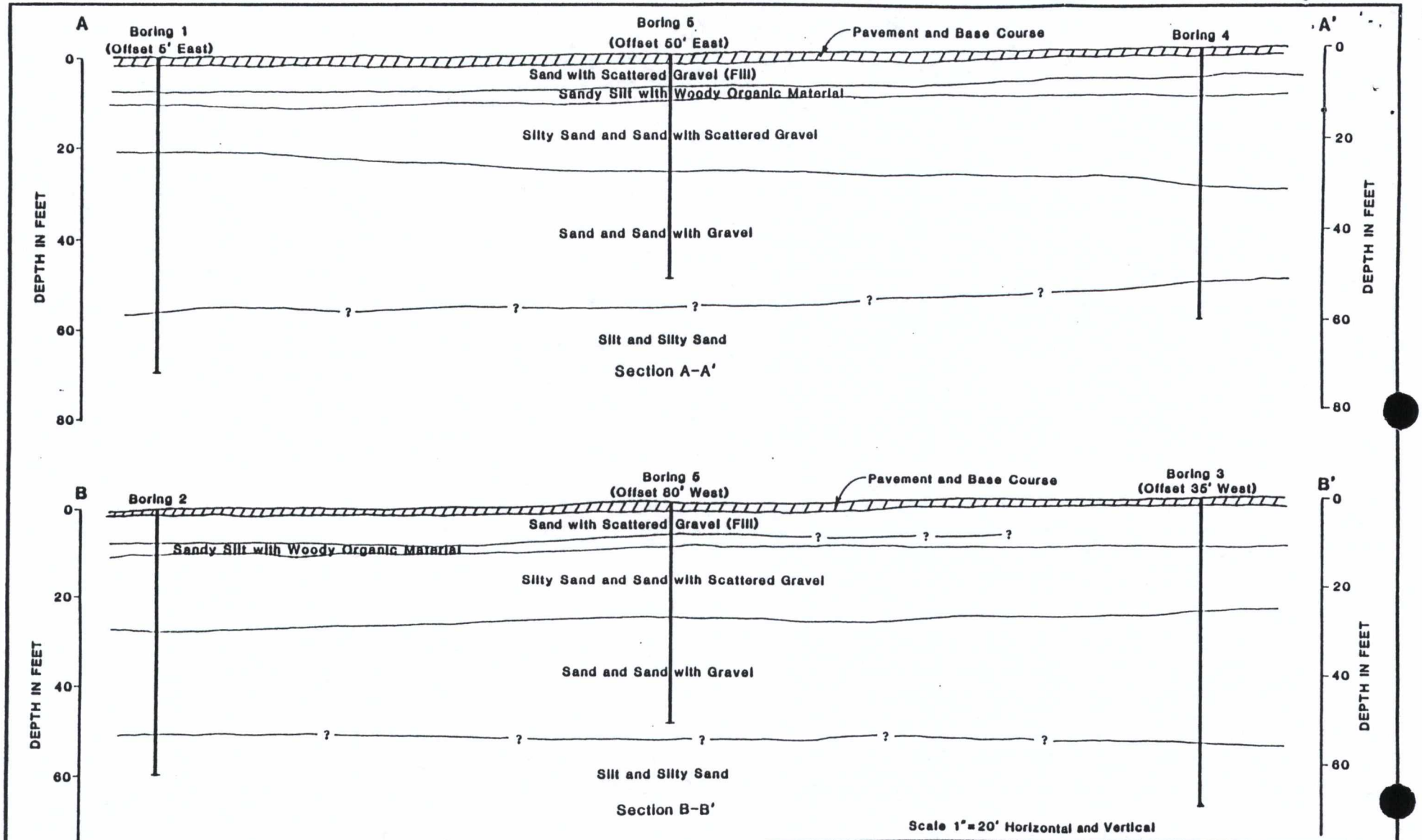
SITE PLAN

FIGURE 1



NOTE: THE SUBSURFACE CONDITIONS SHOWN ON THE PROFILE ARE BASED ON INTERPOLATION BETWEEN WIDELY SPACED EXPLORATIONS AND SHOULD BE CONSIDERED TO BE APPROXIMATE.

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SUBSURFACE PROFILE

FIGURE 2

A P P E N D I X

FIELD EXPLORATIONS AND LABORATORY TESTING

FIELD EXPLORATIONS

Five borings were drilled at the site using truck-mounted, hollow-stem auger drilling equipment. The explorations were begun on January 19 and completed January 21, 1987. Borings 1 and 3 were each drilled to depths of approximately 69-1/2 feet, Borings 2 and 4 each to depths of approximately 59-1/2 feet, and Boring 5 to a depth of approximately 49-1/2 feet. Slotted PVC pipes were installed in Borings 1 and 2 at depths of 69-1/2 feet and 59-1/2 feet, respectively, to permit observation of water levels after completion of drilling and backfilling the borings.

The explorations were observed by an engineering geologist from our staff who obtained samples of the materials examined and classified the soils, recorded ground water conditions, and prepared a detailed log of each boring. The soils were classified in accordance with the Soil Classification System described in Figure A-1. The key to the symbols used on the boring logs is presented in Figure A-2. The logs of the borings are presented in Figures A-3 through A-12. The locations of the borings are shown on the Site Plan, Figure 1.

Samples of the subsurface soils were obtained from the borings at selected intervals using a heavy-duty, split-barrel sampler with brass liner rings. The sampler was driven into the soil using a weight of 300 pounds falling a distance of 30 inches. Unless otherwise noted on the individual sample notation on the boring logs, the sampler was driven into the soil a total depth of 18 inches and the blows recorded that were required to drive the last 12 inches.

LABORATORY TESTING

Samples of the soils obtained during the field explorations were examined and tested in the laboratory to evaluate their pertinent physical characteristics and to develop data for design recommendations. The testing program included moisture and density, direct shear, and consolidation tests.

Moisture and density determinations were made on selected samples for correlation purposes. The results of the moisture and density tests are presented to the left of the corresponding sample notations on the boring logs.

Strength tests consisting of strain-controlled direct shear tests were performed on 11 representative samples of the underlying soils. The results of the direct shear tests are presented in Figures A-13.

Consolidation tests were performed on two samples of the soft, silty soils to provide data for evaluation of settlement under the anticipated building and fill loads. The results of these tests are presented graphically in Figure A-14.

SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE GRAINED SOILS MORE THAN 50% RETAINED ON NO. 200 SIEVE	GRAVEL MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVEL	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
			GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SAND MORE THAN 50% OF COARSE FRACTION PASSES NO. 4 SIEVE	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY-GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE GRAINED SOILS MORE THAN 50% PASSES NO. 200 SIEVE	SILT AND CLAY LIQUID LIMIT LESS THAN 50	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	SILT AND CLAY LIQUID LIMIT 50 OR MORE	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
			CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT

NOTES:

1. Field classification is based on visual examination of soil in general accordance with ASTM D2488-83.
2. Soil classification using laboratory tests is based on ASTM D2487-83.
3. Descriptions of soil density or consistency are based on interpretation of blowcount data, visual appearance of soils, and/or test data.

SOIL MOISTURE MODIFIERS:

Dry – Absence of moisture, dusty, dry to the touch

Moist – Damp, but no visible water

Wet – Visible free water or saturated, usually soil is obtained from below water table

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SOIL CLASSIFICATION SYSTEM

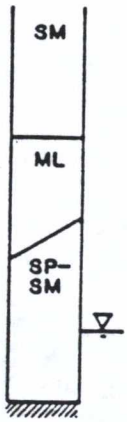
FIGURE A-1

GEI 85-85

LABORATORY TESTS:

AL	Atterberg limits
CP	Compaction
CS	Consolidation
DS	Direct shear
GS	Grain-size analysis
HA	Hydrometer analysis
K	Permeability
M	Moisture content
MD	Moisture and density
SP	Swelling pressure
TX	Triaxial compression
UC	Unconfined compression
CA	Chemical Analysis

SOIL GRAPH:



Soil Group Symbol (See Note 1)

Distinct contact between Soil Strata

Gradual Change between Soil Strata

Water Level

Bottom of Boring

BLOW-COUNT/SAMPLE DATA:

Blows required to drive sampler 12 inches or other indicated distances using 300 pound hammer falling 30 inches.

"P" indicates sampler pushed with weight of hammer or hydraulics of drill rig.

22 ▬ Location of relatively undisturbed sample

12 ⊠ Location of disturbed sample

P □ Location of sampling attempt with no recovery

10 ◪ Location of sample attempt using Standard Penetration Test procedures

40 ▬ Location of relatively undisturbed sample using 140 pound hammer falling 30 inches.

NOTES:

1. Soil classification system is summarized in Figure A-1.
2. The reader must refer to the discussion in the report text as well as the exploration logs for a proper understanding of subsurface conditions.

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GEI 86-86

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KEY TO BORING LOG SYMBOLS

FIGURE A-2

BORING NO. 1

DEPTH IN FEET	Lab Tests	Moisture Content	Dry Density	Blow-Count	Samples	Group Symbol	DESCRIPTION (Surface Elevation: 17.5)
0						GW	4" ASPHALT PAVEMENT
						SP	GRAVEL BASE COURSE DARK BROWNISH-GRAY FINE TO MEDIUM SAND WITH OCCASIONAL GRAVEL (LOOSE, DRY TO MOIST) (FILL)
	DS	9.1%	107	8	■		
5							
	MD	76.9%	73	5	■	ML	MOTTLED GRAY AND BLACK SILT WITH WOODY ORGANIC MATTER AND OCCASIONAL GRAVEL (SOFT TO MEDIUM STIFF, WET)
10						GW	GRAY FINE TO COARSE SANDY GRAVEL WITH SHELL FRAGMENTS (LOOSE TO MEDIUM DENSE, WET)
				6	■	ML	GRAY SILT WITH FINE SAND AND ABUNDANT WOOD FRAGMENTS (SOFT, WET)
15						SM	GRAY SILTY FINE SAND WITH OCCASIONAL GRAVEL AND SHELL FRAGMENTS (LOOSE TO MEDIUM DENSE, WET)
	MD	18.3%	113	8	■		
20						SW/GW	GRAY SAND AND GRAVEL WITH A TRACE OF SILT AND OCCASIONAL SHELL FRAGMENTS (LOOSE TO MEDIUM DENSE, WET)
				9	■		
25							
				14	■	SP	GRAY FINE TO MEDIUM SAND WITH A TRACE OF SILT AND OCCASIONAL SHELL FRAGMENTS (MEDIUM DENSE, WET)
30							
	DS	17.3%	116	27	■		OCCASIONAL WOOD FRAGMENTS
35							
				29	⊠		
40						SW/SM	GRAY FINE TO MEDIUM SAND WITH SILTY FINE TO COARSE SAND AND OCCASIONAL SHELL FRAGMENTS (MEDIUM DENSE TO DENSE, WET)

Note: See Figure A-2 for Explanation of Symbols

10/4-01 1/29/87 KSK:KGB:11

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LOG OF BORING

FIGURE A-3

BORING NO. 1 (Continued)

DEPTH IN FEET	Lab Tests	Moisture Content	Dry Density	Blow-Count	Samples	Group Symbol	DESCRIPTION
40							
				28	■	SP	GRAY FINE TO MEDIUM SAND WITH TRACE SILT, OCCASIONAL WOOD AND SHELL FRAGMENTS (MEDIUM DENSE TO DENSE, WET)
45							
						SM	GRAY SILTY FINE TO MEDIUM SAND WITH ABUNDANT WOOD AND SHELL FRAGMENTS (LOOSE, WET)
	MD	25.3%	100	7	■		
50							
						SP	GRAY FINE TO MEDIUM SAND WITH ABUNDANT SHELL FRAGMENTS, OCCASIONAL WOOD AND COARSE SAND (VERY DENSE, WET)
				74	■		
55							
						ML	GRAY SILT WITH FINE SAND AND OCCASIONAL WOOD AND SHELL FRAGMENTS (SOFT TO MEDIUM STIFF, WET)
	MD	42.2%	78	4	■		
60							
						SM/ML	GRAY SILTY FINE SAND WITH SANDY SILT AND OCCASIONAL SHELL AND WOOD FRAGMENTS (VERY LOOSE TO SOFT, WET)
				3	■		
65							
				4	■		
70							BORING COMPLETED AT 69.5 FEET ON 1/19/87
							OBSERVATION WELL INSTALLED TO 69.5 FEET ON 1/19/87
							WATER LEVEL MEASURED AT 5.2 FEET ON 2/6/87
75							
80							

Note: See Figure A-2 for Explanation of Symbols

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LOG OF BORING

FIGURE A-4

BORING NO. 2

DEPTH IN FEET	Lab Tests	Moisture Content	Dry Density	Blow-Count	Samples	Group Symbol	DESCRIPTION (Surface Elevation: 17.7)
0						GW	3½" ASPHALT PAVEMENT GRAVEL BASE COURSE
						SP	BROWN FINE TO MEDIUM SAND WITH GRAVEL AND OCCASIONAL SHELL FRAGMENTS (MEDIUM DENSE, DRY TO MOIST) (FILL)
	DS	2.5	130	21	■		
5							STRONG HYDROCARBON ODOR - SHEEN ON SAMPLE
				10	⊠	SP/ML	MOTTLED BLACK AND GRAY FINE TO MEDIUM SAND AND SILT (LOOSE, SOFT TO WET) HYDROCARBON ODOR
10						SW	DARK GRAY FINE TO COARSE SAND WITH GRAVEL, OCCASIONAL LARGE WOOD FRAGMENTS AND SHELL FRAGMENTS (LOOSE, WET) HYDROCARBON ODOR OCCASIONAL LENSES OF FINE SAND
				9	■		
15						SP-SM	GRAY FINE SAND WITH SILT AND OCCASIONAL GRAVEL AND SHELL FRAGEMENTS (MEDIUM DENSE, WET)
	MD	20.8	108	13	■		
20						SM/ML	GRAY SILTY FINE SAND AND FINE SANDY SILT WITH OCCASIONAL GRAVEL, WOOD AND SHELL FRAGMENTS (VERY LOOSE TO SOFT, WET)
	MD	71.7	63	4	■		
25							
				31	□	SW	GRAY FINE TO COARSE SAND WITH GRAVEL AND SILT (MEDIUM DENSE, WET)
30							
				20	■		
35						SP/SW	GRAY FINE TO MEDIUM SAND WITH ABUNDANT SHELL AND WOOD FRAGMENTS AND GRAY FINE TO COARSE SAND WITH GRAVEL (MEDIUM DENSE, WET)
	DS	11.4%	127	32	■		
40							

Note: See Figure A-2 for Explanation of Symbols

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LOG OF BORING

FIGURE A-5

BORING NO. 2 (Continued)

DEPTH IN FEET	Lab Tests	Moisture Content	Dry Density	Blow-Count	Samples	Group Symbol	DESCRIPTION
40							
				48	⊠		
45						SM/SP	GRAY SILTY FINE SAND AND FINE SAND WITH OCCASIONAL SHELL FRAGMENTS (MEDIUM DENSE, WET)
	DS	20.3%	107	15	■		
50						SM	GRAY SILTY FINE TO MEDIUM SAND WITH SHELL FRAGMENTS (LOOSE, WET)
				4	■		
55						ML	GRAY FINE SANDY SILT WITH OCCASIONAL SHELL AND WOOD FRAGMENTS (SOFT TO MEDIUM STIFF, WET)
	CS	41.5%	80	4	■		
60							BORING COMPLETED AT 59.5 FEET ON 1/20/87
							OBSERVATION WELL INSTALLED TO 59.5 FEET ON 1/20/87
65							WATER LEVEL MEASURED AT 4.4 FEET ON 2/6/87
70							
75							
80							

Note: See Figure A-2 for Explanation of Symbols

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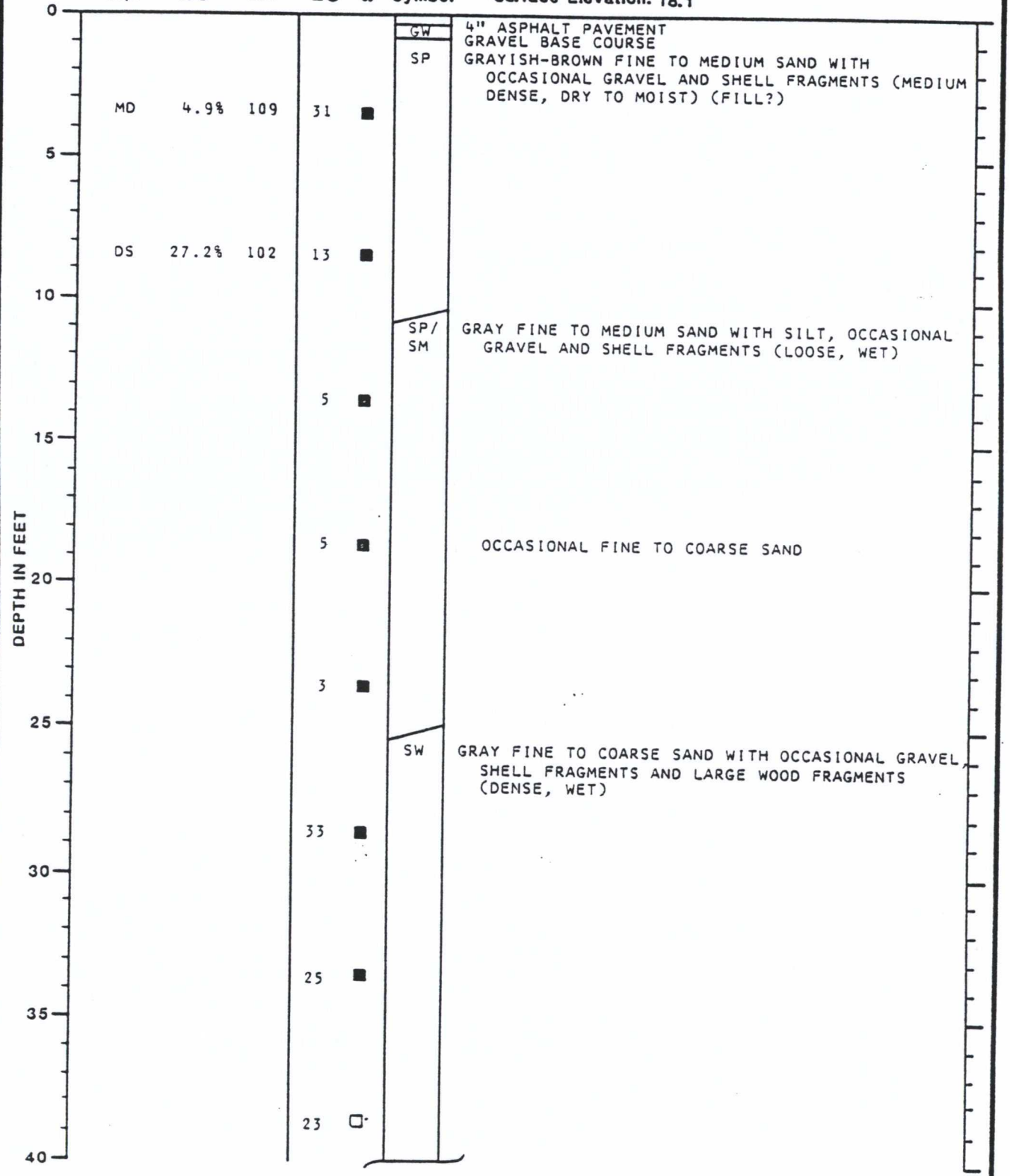
LOG OF BORING

FIGURE A-6

BORING NO. 3



Note: See Figure A-2 for Explanation of Symbols

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LOG OF BORING

FIGURE A-7

BORING NO. 3
(Continued)

DEPTH IN FEET	Lab Tests	Moisture Content	Dry Density	Blow-Count	Samples	Group Symbol	DESCRIPTION
40						SP	GRAY FINE TO MEDIUM SAND WITH OCCASIONAL COARSE SAND AND GRAVEL AND ABUNDANT SHELL FRAGMENTS (MEDIUM DENSE, WET)
	DS	15.1%	116	23	■		
45							
				14	■	SW	GRAY FINE TO COARSE SAND WITH GRAVEL AND ABUNDANT SHELL FRAGMENTS (MEDIUM DENSE, WET)
50							
				9	■		
55						ML	GRAY FINE SANDY SILT WITH OCCASIONAL SHELL AND WOOD FRAGMENTS (SOFT TO MEDIUM STIFF, WET)
	MD	37.3%	83	3	■		
60							
				5	■	SM	GRAY SILTY FINE SAND WITH OCCASIONAL SHELL FRAGMENTS (LOOSE, WET)
65							
	MD	35.4%	85	6	■	ML	GRAY FINE SANDY SILT WITH OCCASIONAL SHELL AND WOOD FRAGMENTS (MEDIUM STIFF, WET)
70							BORING COMPLETED AT 69.5 FEET ON 1/19/87
							WATER LEVEL MEASURED AT 4.45 FEET ON 2/6/87
75							
80							

Note: See Figure A-2 for Explanation of Symbols

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LOG OF BORING

FIGURE A-8

BORING NO. 4

DEPTH IN FEET	Lab Tests	Moisture Content	Dry Density	Blow-Count	Samples	Group Symbol	DESCRIPTION (Surface Elevation: 17.6)
0							4" ASPHALT PAVEMENT
						GM	GRAVEL BASE COURSE
						SP	BROWN FINE TO MEDIUM SAND WITH OCCASIONAL GRAVEL AND A TRACE OF SHELL FRAGMENTS (LOOSE, DRY TO MOIST) (FILL)
5	MD	9.8%	114	9	■		
						ML	MOTTLED GRAY AND BLACK SILT WITH OCCASIONAL WOODY ORGANIC MATTER AND PODS OF BROWN AND GRAY FINE SAND (SOFT AND MEDIUM STIFF, WET) (FILL?)
	MD	49.7%	43	4	■		
10						SP/ SM	GRAY FINE TO MEDIUM SAND WITH SILT AND OCCASIONAL GRAVEL (LOOSE, WET)
				3	□		
15							
				4	⊠		
20						SM	GRAY SILTY FINE TO MEDIUM SAND WITH GRAVEL AND SHELL FRAGMENTS (VERY LOOSE, WET)
	DS	23.6%	103	2	■		
25							
				18	⊠		
30						SW/ SM	GRAY FINE TO COARSE SAND WITH SILT, OCCASIONAL GRAVEL AND ABUNDANT SHELL FRAGMENTS (LOOSE TO MEDIUM DENSE, WET)
	MD	14.5%	125	10	■		
35						SW	GRAY FINE TO COARSE SAND WITH GRAVEL AND ABUNDANT SHELL FRAGMENTS (DENSE, WET)
				35	■		
40							

Note: See Figure A-2 for Explanation of Symbols

1074-01 KSK:KGB:fl 1/29/87

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LOG OF BORING

FIGURE A-9

BORING NO. 4 (Continued)

DEPTH IN FEET	Lab Tests	Moisture Content	Dry Density	Blow-Count	Samples	Group Symbol	DESCRIPTION
40						SP-SM	GRAY FINE TO MEDIUM SAND WITH SILT AND OCCASIONAL WOOD FRAGMENTS (MEDIUM DENSE, WET)
				14	■		
45						SP	GRAY FINE TO MEDIUM SAND WITH A TRACE OF SILT AND OCCASIONAL SHELL FRAGMENTS (DENSE, WET)
	DS	15.1%	119	37	■		
50						SM	GRAY SILTY FINE SAND WITH OCCASIONAL SHELL FRAGMENTS (LOOSE, WET)
				4	■		
55						ML	GRAY FINE SANDY SILT WITH OCCASIONAL SHELL FRAGMENTS AND LENSES OF SILTY FINE SAND (SOFT TO MEDIUM STIFF, WET)
	CS	28.5%	92	4	■		
60							BORING COMPLETED AT 59.5 FEET ON 1/20/87
65							
70							
75							
80							

Note: See Figure A-2 for Explanation of Symbols

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LOG OF BORING

FIGURE A-10

BORING NO. 5

Depth in Feet	Lab Tests	Moisture Content	Dry Density	Blow-Count	Samples	Group Symbol	Description
							Surface Elevation: 17.9
0							4" ASPHALT PAVEMENT
						GW	GRAVEL BASE COURSE
						SP	GRAYISH-BROWN FINE TO MEDIUM SAND WITH OCCASIONAL GRAVEL (LOOSE, DRY TO MOIST) (FILL?)
	MD	3.7%	103	7	■		
5						ML	MOTTLED GRAY AND BLACK FINE SANDY SILT WITH OCCASIONAL WOODY ORGANIC MATTER (MEDIUM STIFF, (WET)
				17	■	SM	DARK GRAY SILTY FINE TO MEDIUM SAND WITH GRAVEL AND OCCASIONAL SHELL FRAGMENTS (MEDIUM DENSE, WET)
10						SW	GRAY FINE TO COARSE SAND WITH GRAVEL (LOOSE TO MEDIUM DENSE, WET)
				10	⊠		
15						SP-SM	GRAY FINE SAND WITH SILT AND OCCASIONAL WOOD FRAGMENTS (LOOSE TO MEDIUM DENSE, WET)
	MD	24.5%	101	11	■		
20						SM	GRAY SILTY FINE SAND WITH OCCASIONAL WOOD FRAGMENTS (VERY LOOSE, WET)
	DS	30.2%	88	3	■		
25						SW	GRAY GRAVELLY FINE TO COARSE SAND WITH OCCASIONAL SHELL FRAGMENTS (DENSE, WET)
				41	■		
30							
				14	□		
35							
	MD	13.1%	125	30	■		
40							

DEPTH IN FEET

Note: See Figure A-2 for Explanation of Symbols

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LOG OF BORING

FIGURE A-11

10/4-01 KSK:KGB:ll 1/29/87

BORING NO. 5 (Continued)

DEPTH IN FEET	Lab Tests	Moisture Content	Dry Density	Blow-Count	Samples	Group Symbol	DESCRIPTION
40						SP	GRAY FINE TO MEDIUM SAND WITH A TRACE OF SILT, OCCASIONAL GRAVEL AND ABUNDANT SHELL FRAGMENTS (MEDIUM DENSE, WET)
				19	■		
45							
	DS	18.0%	113	32	■		
50							BORING COMPLETED AT 49.5 FEET ON 1/20/87
55							
60							
65							
70							
75							
80							

Note: See Figure A-2 for Explanation of Symbols

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LOG OF BORING

FIGURE A-12

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*SUMMARY OF DIRECT SHEAR TEST DATA

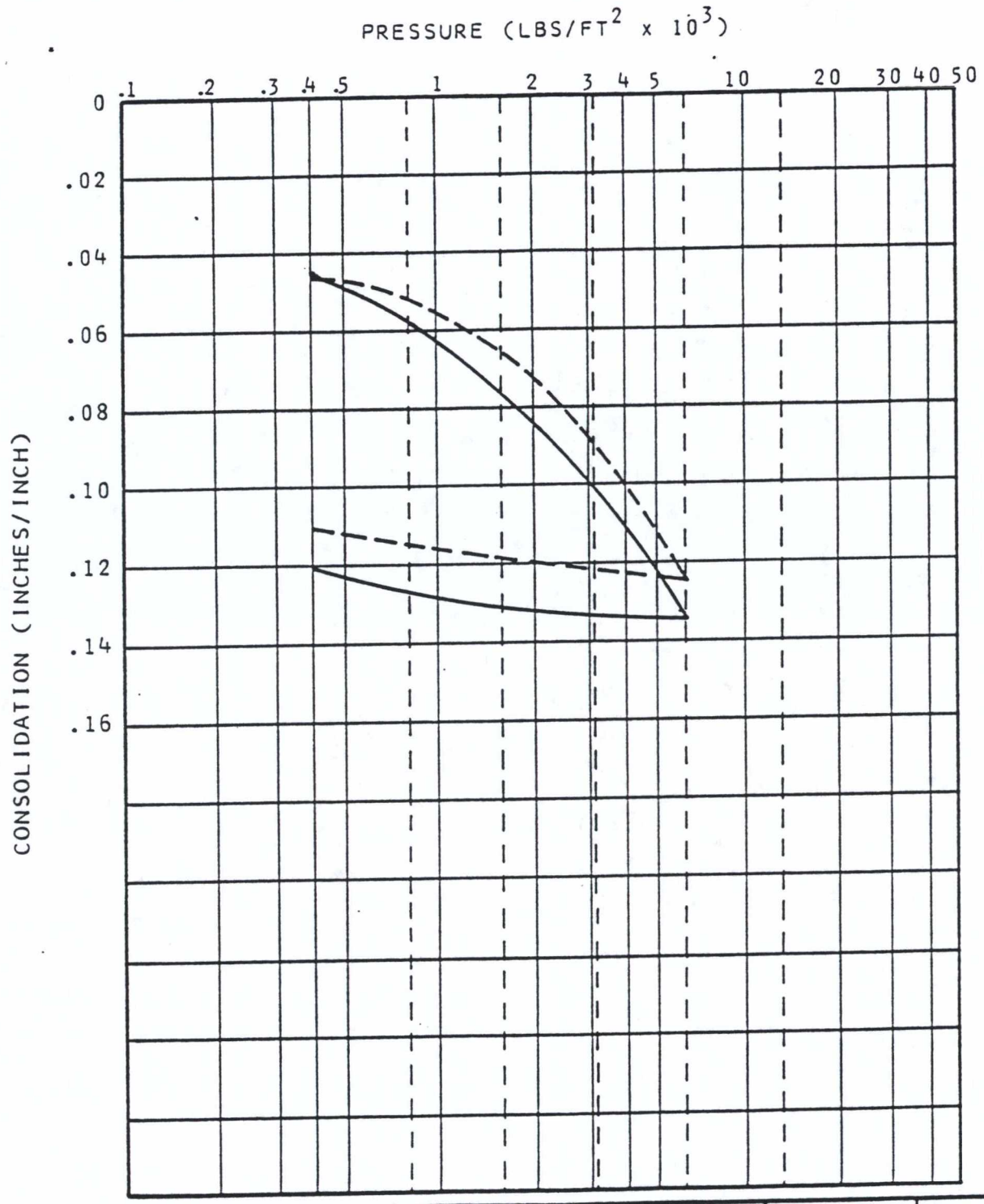
1074-01

Boring Number	Sample Depth (ft)	Sample Description	Moisture Content (%)	Dry Density (pcf)	Normal Pressure (psf)	Peak Shear Strength (psf)
1	3.5	Fine to medium sand with gravel (SP)	9.1	107	500	410
1	33.5	Fine to medium sand (SP)	17.3	116	3000	2600
2	3.5	Medium to coarse sandy gravel (GW)	2.5	130	700	260
2	38.5	Fine to coarse sand with gravel (SP/SW)	11.4	127	3500	5000
2	48.5	Silty Sand (SM)	20.3	107	4500	4300
3	8.5	Silty fine to medium sand (SM)	27.2	102	1000	900
3	43.5	Medium to coarse sand with gravel (SP)	15.1	116	4000	3300
4	23.5	Silty fine sand (SM)	23.6	103	2000	1200
4	48.5	Medium sand (SP)	15.1	119	4200	4100
5	23.5	Fine sandy silt (ML)	30.2	88	2500	850
5	48.5	Silty medium sand (SM)	18.0	113	4000	3300

* All tests performed on submerged samples at a shear rate of 0.05 inches per minute.

SUMMARY OF DIRECT SHEAR TEST DATA

FIGURE A-13



KEY	BORING NUMBER	SAMPLE DEPTH (FT)	SOIL CLASSIFICATION	MOISTURE CONTENT	DRY DENSITY (LBS/FT^3)
——	2	58.5	SILT (ML)	41.5%	80
– – –	4	58.5	SANDY SILT (ML)	28.5%	92

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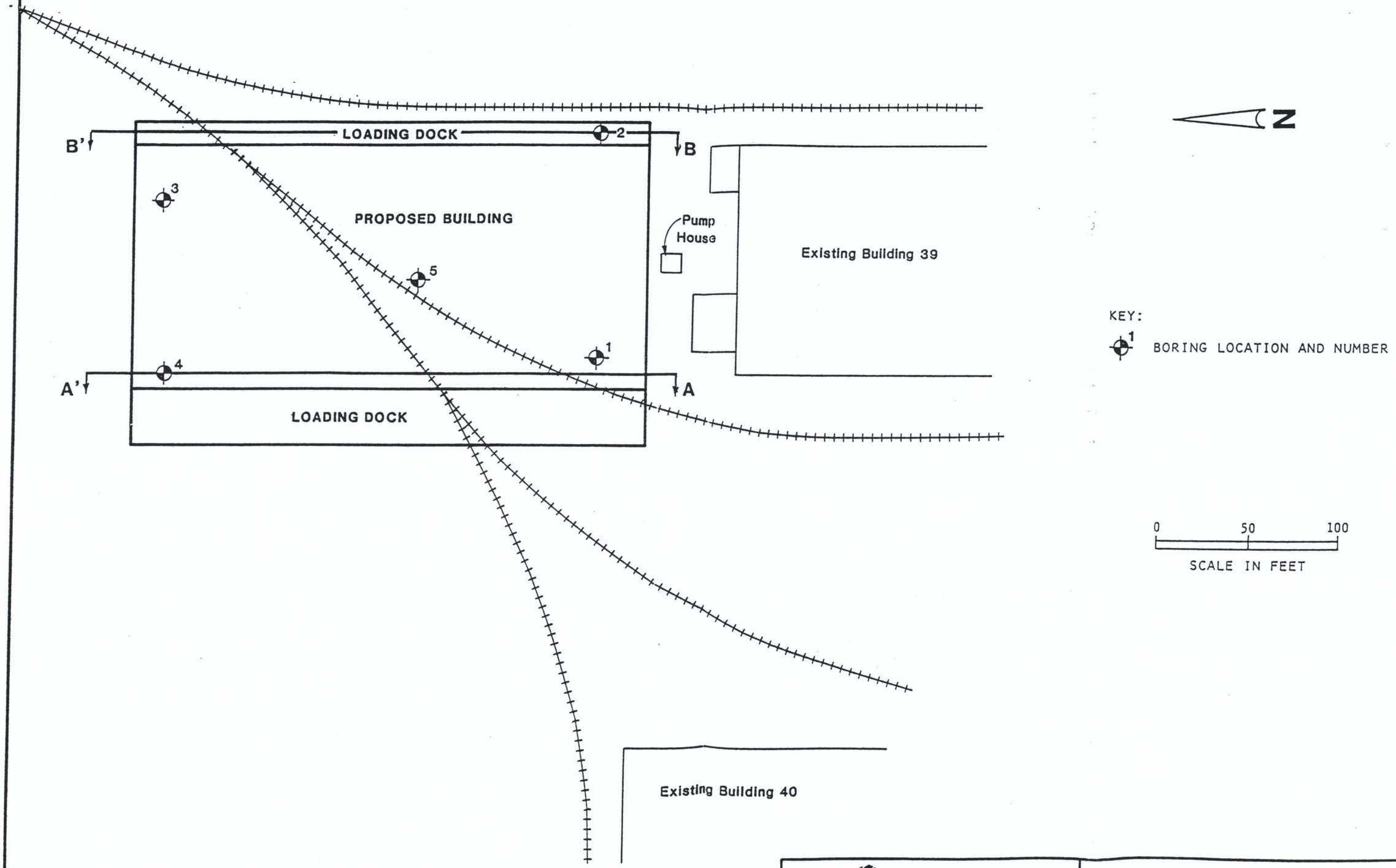
CONSOLIDATION TEST RESULTS

FIGURE A-14



REFERENCE: DRAWING ENTITLED "TOPOGRAPHIC AND UTILITY SURVEY - AREA SURROUNDING AND NORTH OF BUILDING 39" BY HARSTAD CONSULTANTS FOR CITY ICE AND ICE STORAGE COMPANY, DATED JAN. 1987.

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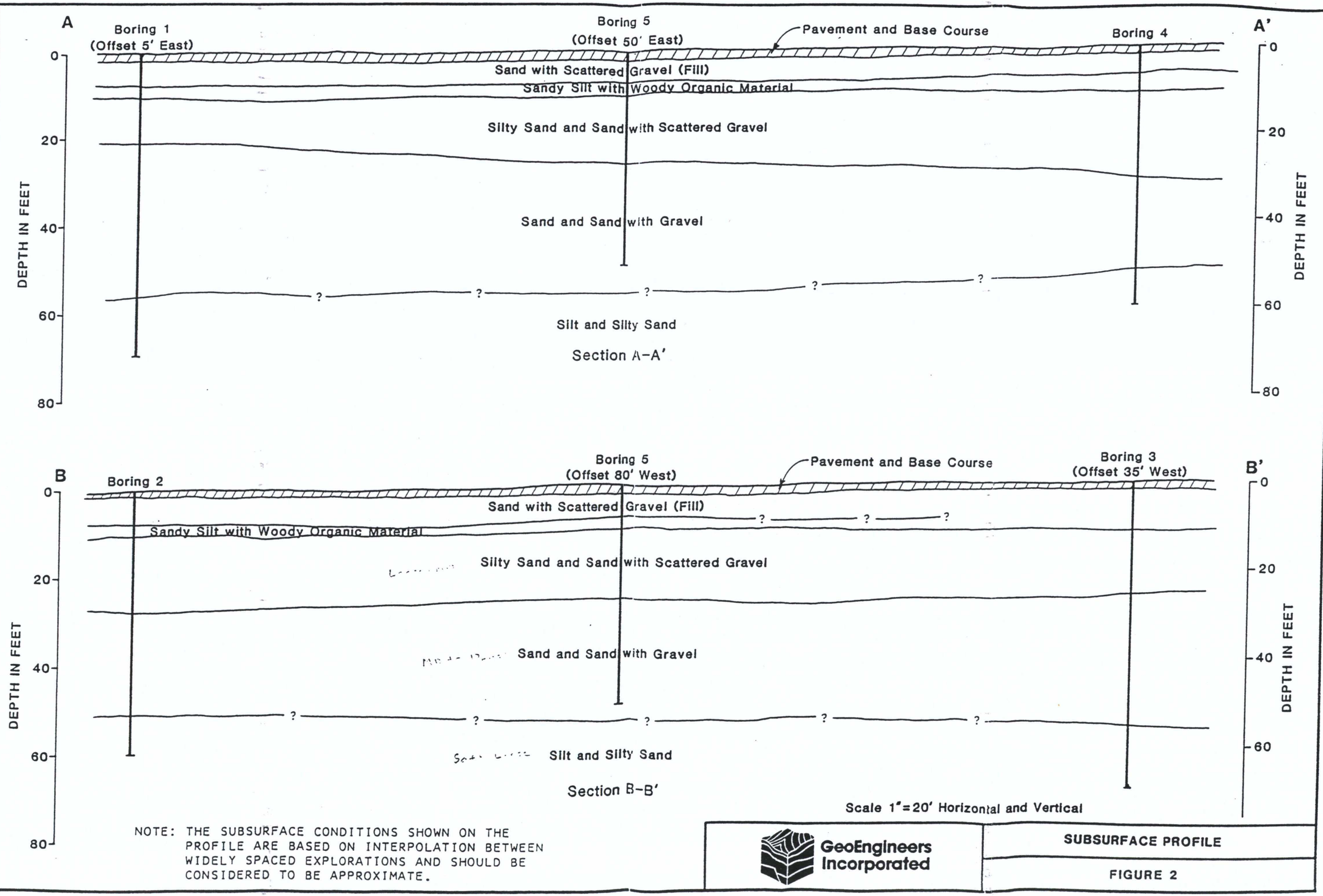
SITE PLAN

FIGURE 1



NOTE: THE SUBSURFACE CONDITIONS SHOWN ON THE PROFILE ARE BASED ON INTERPOLATION BETWEEN WIDELY SPACED EXPLORATIONS AND SHOULD BE CONSIDERED TO BE APPROXIMATE.

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SUBSURFACE PROFILE

FIGURE 2

BORING NO. 1

DEPTH IN FEET	Lab Tests	Moisture Content	Dry Density	Blow-Count	Samples	Group Symbol	DESCRIPTION (Surface Elevation: 17.5)
0						GW	4" ASPHALT PAVEMENT
							GRAVEL BASE COURSE
						SP	DARK BROWNISH-GRAY FINE TO MEDIUM SAND WITH OCCASIONAL GRAVEL (LOOSE, DRY TO MOIST) (FILL)
	DS	9.1%	107	8	■		
5							
	MD	76.9%	73	5	■	ML	MOTTLED GRAY AND BLACK SILT WITH WOODY ORGANIC MATTER AND OCCASIONAL GRAVEL (SOFT TO MEDIUM STIFF, WET)
10						GW	GRAY FINE TO COARSE SANDY GRAVEL WITH SHELL FRAGMENTS (LOOSE TO MEDIUM DENSE, WET)
				6	■	ML	GRAY SILT WITH FINE SAND AND ABUNDANT WOOD FRAGMENTS (SOFT, WET)
						SM	GRAY SILTY FINE SAND WITH OCCASIONAL GRAVEL AND SHELL FRAGMENTS (LOOSE TO MEDIUM DENSE, WET)
15							
	MD	18.3%	113	8	■		
20						SW/GW	GRAY SAND AND GRAVEL WITH A TRACE OF SILT AND OCCASIONAL SHELL FRAGMENTS (LOOSE TO MEDIUM DENSE, WET)
				9	■		
25							
				14	■	SP	GRAY FINE TO MEDIUM SAND WITH A TRACE OF SILT AND OCCASIONAL SHELL FRAGMENTS (MEDIUM DENSE, WET)
30							
	DS	17.3%	116	27	■		OCCASIONAL WOOD FRAGMENTS
35							
				29	⊠	SW/SM	GRAY FINE TO MEDIUM SAND WITH SILTY FINE TO COARSE SAND AND OCCASIONAL SHELL FRAGMENTS (MEDIUM DENSE TO DENSE, WET)
40							

Note: See Figure A-2 for Explanation of Symbols

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LOG OF BORING

FIGURE A-3

1074-01 1/29/87 KSK:KGB:EL

BORING NO. 1 (Continued)

DEPTH IN FEET	TEST DATA: Lab Tests	Moisture Content	Dry Density	Blow-Count	Samples	Group Symbol	DESCRIPTION
40							
				28	■	SP	GRAY FINE TO MEDIUM SAND WITH TRACE SILT, OCCASIONAL WOOD AND SHELL FRAGMENTS (MEDIUM DENSE TO DENSE, WET)
45							
						SM	GRAY SILTY FINE TO MEDIUM SAND WITH ABUNDANT WOOD AND SHELL FRAGMENTS (LOOSE, WET)
	MD	25.3%	100	7	■		
50							
						SP	GRAY FINE TO MEDIUM SAND WITH ABUNDANT SHELL FRAGMENTS, OCCASIONAL WOOD AND COARSE SAND (VERY DENSE, WET)
				74	■		
55							
						ML	GRAY SILT WITH FINE SAND AND OCCASIONAL WOOD AND SHELL FRAGMENTS (SOFT TO MEDIUM STIFF, WET)
	MD	42.2%	78	4	■		
60							
						SM/ML	GRAY SILTY FINE SAND WITH SANDY SILT AND OCCASIONAL SHELL AND WOOD FRAGMENTS (VERY LOOSE TO SOFT, WET)
				3	■		
65							
				4	■		
70							BORING COMPLETED AT 69.5 FEET ON 1/19/87
							OBSERVATION WELL INSTALLED TO 69.5 FEET ON 1/19/87
							WATER LEVEL MEASURED AT 5.2 FEET ON 2/6/87
75							
80							

Note: See Figure A-2 for Explanation of Symbols

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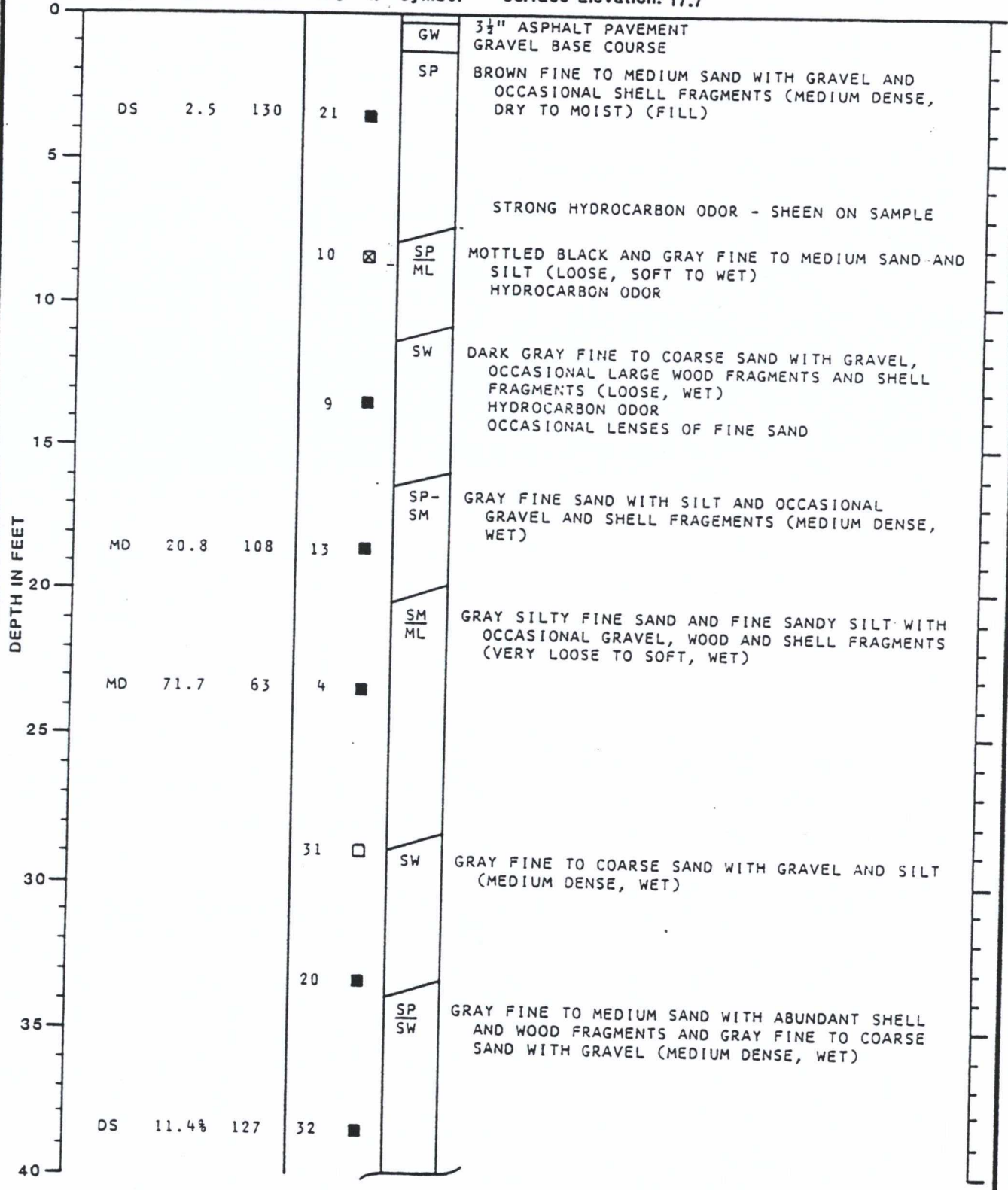
LOG OF BORING

FIGURE A-4

1074-01 KSK:KGB:EL 1/29/87

BORING NO. 2



Note: See Figure A-2 for Explanation of Symbols

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LOG OF BORING

FIGURE A-5

BORING NO. 2 (Continued)

DEPTH IN FEET	Lab Tests	Moisture Content	Dry Density	Blow-Count	Samples	Group Symbol	DESCRIPTION
40							
				48	⊠		
45						SM/SP	GRAY SILTY FINE SAND AND FINE SAND WITH OCCASIONAL SHELL FRAGMENTS (MEDIUM DENSE, WET)
	DS	20.3%	107	15	■		
50						SM	GRAY SILTY FINE TO MEDIUM SAND WITH SHELL FRAGMENTS (LOOSE, WET)
				4	■		
55						ML	GRAY FINE SANDY SILT WITH OCCASIONAL SHELL AND WOOD FRAGMENTS (SOFT TO MEDIUM STIFF, WET)
	CS	41.5%	80	4	■		
60							BORING COMPLETED AT 59.5 FEET ON 1/20/87
							OBSERVATION WELL INSTALLED TO 59.5 FEET ON 1/20/87
							WATER LEVEL MEASURED AT 4.4 FEET ON 2/6/87
65							
70							
75							
80							

Note: See Figure A-2 for Explanation of Symbols

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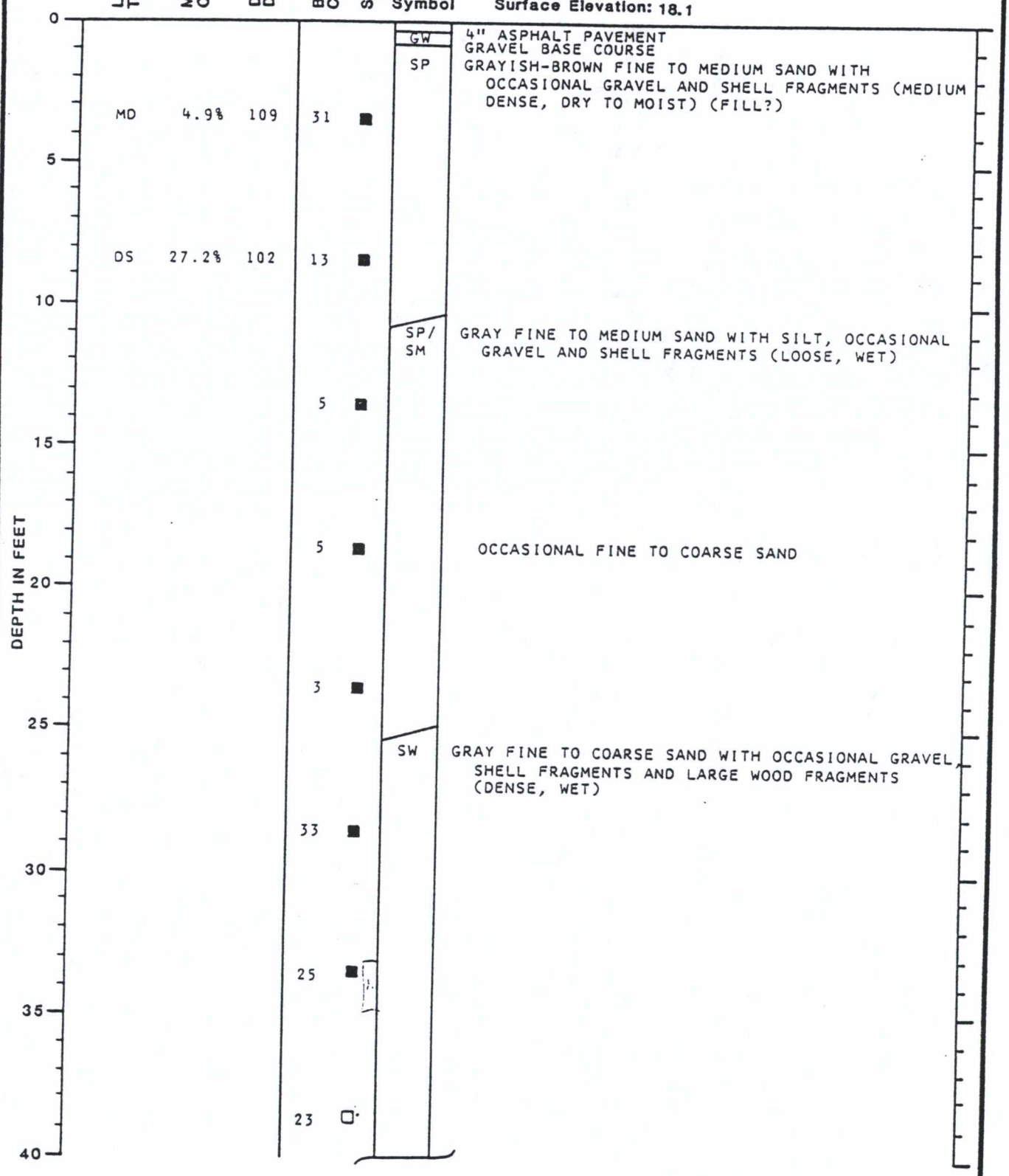
LOG OF BORING

FIGURE A-6

1074-01 KSK:KGB:tl 1/29/87

BORING NO. 3



Note: See Figure A-2 for Explanation of Symbols

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LOG OF BORING

FIGURE A-7

BORING NO. 3 (Continued)

DEPTH IN FEET	Lab Tests	Moisture Content	Dry Density	Blow-Count	Samples	Group Symbol	DESCRIPTION
40						SP	GRAY FINE TO MEDIUM SAND WITH OCCASIONAL COARSE SAND AND GRAVEL AND ABUNDANT SHELL FRAGMENTS (MEDIUM DENSE, WET)
	DS	15.1%	116	23	■		
45							
				14	■	SW	GRAY FINE TO COARSE SAND WITH GRAVEL AND ABUNDANT SHELL FRAGMENTS (MEDIUM DENSE, WET)
50							
				9	■		
55						ML	GRAY FINE SANDY SILT WITH OCCASIONAL SHELL AND WOOD FRAGMENTS (SOFT TO MEDIUM STIFF, WET)
	MD	37.3%	83	3	■		
60							
				5	■	SM	GRAY SILTY FINE SAND WITH OCCASIONAL SHELL FRAGMENTS (LOOSE, WET)
65							
	MD	35.4%	85	6	■	ML	GRAY FINE SANDY SILT WITH OCCASIONAL SHELL AND WOOD FRAGMENTS (MEDIUM STIFF, WET)
70							BORING COMPLETED AT 69.5 FEET ON 1/19/87
							WATER LEVEL MEASURED AT 4.45 FEET ON 2/6/87
75							
80							

Note: See Figure A-2 for Explanation of Symbols

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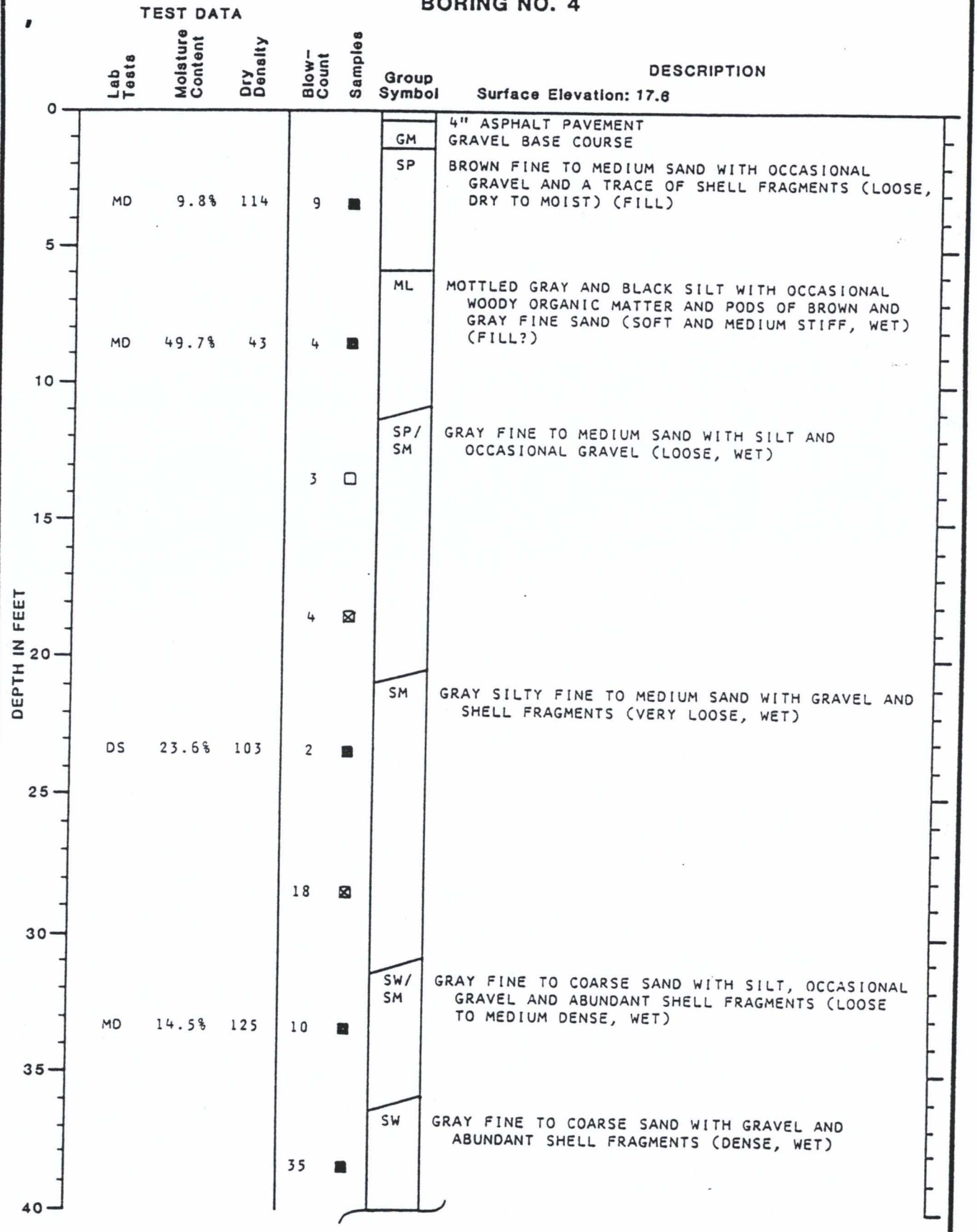
LOG OF BORING

FIGURE A-8

1074-01 KSK:KGH:EL 1/29/87

BORING NO. 4



Note: See Figure A-2 for Explanation of Symbols

1074-01 KSK:KGB:EL 1/29/87

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LOG OF BORING

FIGURE A-9

BORING NO. 4 (Continued)

DEPTH IN FEET	Lab Tests	Moisture Content	Dry Density	Blow-Count	Samples	Group Symbol	DESCRIPTION
40						SP-SM	GRAY FINE TO MEDIUM SAND WITH SILT AND OCCASIONAL WOOD FRAGMENTS (MEDIUM DENSE, WET)
				14	■		
45						SP	GRAY FINE TO MEDIUM SAND WITH A TRACE OF SILT AND OCCASIONAL SHELL FRAGMENTS (DENSE, WET)
	DS	15.1%	119	37	■		
50						SM	GRAY SILTY FINE SAND WITH OCCASIONAL SHELL FRAGMENTS (LOOSE, WET)
				4	■		
55						ML	GRAY FINE SANDY SILT WITH OCCASIONAL SHELL FRAGMENTS AND LENSES OF SILTY FINE SAND (SOFT TO MEDIUM STIFF, WET)
	CS	28.5%	92	4	■		
60							BORING COMPLETED AT 59.5 FEET ON 1/20/87
65							
70							
75							
80							

Note: See Figure A-2 for Explanation of Symbols

1074-01 KSK:KGB:EL 1/29/87

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LOG OF BORING

FIGURE A-10

BORING NO. 5

DEPTH IN FEET	Lab Tests	Moisture Content	Dry Density	Blow-Count	Samples	Group Symbol	DESCRIPTION (Surface Elevation: 17.9)
0							4" ASPHALT PAVEMENT
						GW	GRAVEL BASE COURSE
						SP	GRAYISH-BROWN FINE TO MEDIUM SAND WITH OCCASIONAL GRAVEL (LOOSE, DRY TO MOIST) (FILL?)
	MD	3.7%	103	7	■		
5							
						ML	MOTTLED GRAY AND BLACK FINE SANDY SILT WITH OCCASIONAL WOODY ORGANIC MATTER (MEDIUM STIFF, (WET)
				17	■		
						SM	DARK GRAY SILTY FINE TO MEDIUM SAND WITH GRAVEL AND OCCASIONAL SHELL FRAGMENTS (MEDIUM DENSE, WET)
10							
						SW	GRAY FINE TO COARSE SAND WITH GRAVEL (LOOSE TO MEDIUM DENSE, WET)
				10	⊠		
15							
						SP-SM	GRAY FINE SAND WITH SILT AND OCCASIONAL WOOD FRAGMENTS (LOOSE TO MEDIUM DENSE, WET)
	MD	24.5%	101	11	■		
20							
						SM	GRAY SILTY FINE SAND WITH OCCASIONAL WOOD FRAGMENTS (VERY LOOSE, WET)
	DS	30.2%	88	3	■		
25							
						SW	GRAY GRAVELLY FINE TO COARSE SAND WITH OCCASIONAL SHELL FRAGMENTS (DENSE, WET)
				41	■		
30							
				14	□		
35							
	MD	13.1%	125	30	■		
40							

Note: See Figure A-2 for Explanation of Symbols

1074-01 KSK:KGB:EL 1/29/87

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LOG OF BORING

FIGURE A-11

BORING NO. 5 (Continued)

TEST DATA						DESCRIPTION
Lab Tests	Moisture Content	Dry Density	Blow-Count	Samples	Group Symbol	
					SP	GRAY FINE TO MEDIUM SAND WITH A TRACE OF SILT, OCCASIONAL GRAVEL AND ABUNDANT SHELL FRAGMENTS (MEDIUM DENSE, WET)
			19	■		
DS	18.0%	113	32	■		
						BORING COMPLETED AT 49.5 FEET ON 1/20/87

DEPTH IN FEET: 40, 45, 50, 55, 60, 65, 70, 75, 80

Note: See Figure A-2 for Explanation of Symbols

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LOG OF BORING

FIGURE A-12